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"TRUST ME—I'LL DELIVER" :ACQUISITION APPROACHES TO GUARANTEE COMMERCIAL COMPANIES DELIVER CRITICAL SPACE PRODUCTS IN TIME OF CRISIS

by

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The DOD historically designs, develops, owns, and operates the systems to meet its requirements for space-based imagery, voice and data communications, weather, and navigation information. However, over the last ten years, the US military has begun to rely on commercially available products to meet many of its requirements in a variety of sectors including the commercial space sector. The commercial space sector?s capability to provide competitive options for data and voice communications, and more recently satellite imagery, continues to fuel this trend to the point the DOD must rely on commercial companies for critical products. This reliance is causing many inside the DOD to ask the question addressed in this paper: can the DOD guarantee warfighters? requirements are met in time of crisis by using appropriate acquisition approaches? To answer this question the paper is organized into five sections: a review and analysis of the trends driving the military to rely on the commercial space sector; a summary of military requirements being met by the commercial space sector; an analysis of how to reduce the risks of reliance on the commercial sector; an evaluation of several acquisition approaches; and finally, a recommended acquisition approach to guarantee commercial delivery of critical products in time of crisis.

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Preface

After many years as an acquisition officer developing and testing space systems, I jumped at the opportunity to be responsible for real-time satellite operations and cross-trained into the space and missile career field. I operated a system completely owned and controlled by the USAF—just like most space systems used by the military—and I never worried about the system's ability to respond to warfighters' needs. However, this is changing as the commercial sector encroaches into what used to be a military-only domain. This evolution is also changing the fundamental relationship between the military and the commercial sector as we look to the commercial sector to meet critical requirements. The bottom line is we're becoming reliant on the commercial sector even though we don't control the assets. Is this the potential "Achilles heel" of our space support to deployed forces? My worst fear is a warfighter half way around the world not receiving critical space products because the US military "customer" became Company XYZ's second priority. To resolve this concern I set out to find an acquisition approach meeting both the military needs for reliable delivery and the vendor drive for profits in a predominately commercial-driven market.

Many individuals provided substantial assistance in my attempt to make sense of this complex issue. I would like to thank the individuals interviewed for this project and for the many perspectives they offered: Col Roy Block, Steve Miller, and Dick Schonberger, DISA/D3; Randy Ferryman and Clay Ancell, NIMA; Scott Pace, Rand Corporation; Maj

Gen Robert Dickman, OSD Space Architect; Brig Gen James Beale and Col Rick Skinner, SAF/AQS; Lt Col Jim Puhek and Maj Kay Martin, Joint Staff; Mr John Langdon and Lt Col Ed Alexander, DUSD (Space); Jay Rixse, NRO; and, Gil Rye, Orbimage Corporation. In addition, several individuals offered particular assistance: Brig Gen John Clay, SMC/CV, who provided insights each step of the way; Lt Col Ed Alexander, who provided the original push to explore this topic, Lt Col Terry Clark, who tirelessly reviewed draft after draft and kept me focused on finding a solution; Mr Norm McDaniel and CMDR Dave Brown, acquisition professionals who helped keep me honest; and Maj Dan Stockton, who acted as a sounding board for my ideas and routinely caused me to dig a little deeper.

Abstract

The DOD historically designs, develops, owns, and operates the systems to meet its requirements for space-based imagery, voice and data communications, weather, and navigation information. However, over the last ten years, the US military has begun to rely on commercially available products to meet many of its requirements in a variety of sectors including the commercial space sector. The commercial space sector's capability to provide competitive options for data and voice communications, and more recently satellite imagery, continues to fuel this trend to the point the DOD must *rely* on commercial companies for critical products. This reliance is causing many inside the DOD to ask the question addressed in this paper: can the DOD guarantee warfighters' requirements are met in time of crisis by using appropriate acquisition approaches? To answer this question the paper is organized into five sections: a review and analysis of the trends driving the military to rely on the commercial space sector; a summary of military requirements being met by the commercial space sector; an analysis of how to reduce the risks of reliance on the commercial sector; an evaluation of several acquisition approaches; and finally, a recommended acquisition approach to guarantee commercial delivery of critical products in time of crisis.

Chapter 1

Introduction

> *We've overburdened satellites…we are demanding too much from limited assets.*
>
> —Lt Gen Walter E. Boomer, USMC
> *Commander of the US Marines in the Gulf during DESERT STORM*

DESERT STORM proved satellites are a powerful force multiplier for military operations but it also demonstrated warfighters want more products from space assets than they can get from military systems alone. Despite General Boomer's caution, the military's vision for future combat includes a far greater role for space. In fact, *Joint Vision 2010* rests on a foundation called Information Superiority, which requires more space assets than ever before. Information Superiority is crucial because it achieves superior battlespace awareness and allows Network Centric Warfare (NCW) by employing a global network of three interconnected grids. The NCW concept connects information collectors tied together in a *sensor grid* through an *information grid* to tactical units linked on the battlefield in an *engagement grid*. The entire network *is* Information Superiority as depicted in Figure 1.[1] This vision requires investments to build essentially a new combat system even though the Department of Defense (DOD) budget is decreasing substantially.

The solution to this quandary is found in the commercial space sector by using commercial companies to provide some of the systems making up the grids. However,

there are risks of relying in industry for these critical products and services. One of the biggest risks to a warfighter is not receiving critical space products in time of crisis. So before the commercial space sector is accepted as the solution to this problem, a few basic questions need to be addressed: 1) what trends are pressuring the military to rely heavily on the commercial space sector, and if the military must rely on the commercial space sector, 2) what requirements are being met by the commercial space sector, and 3) how can the

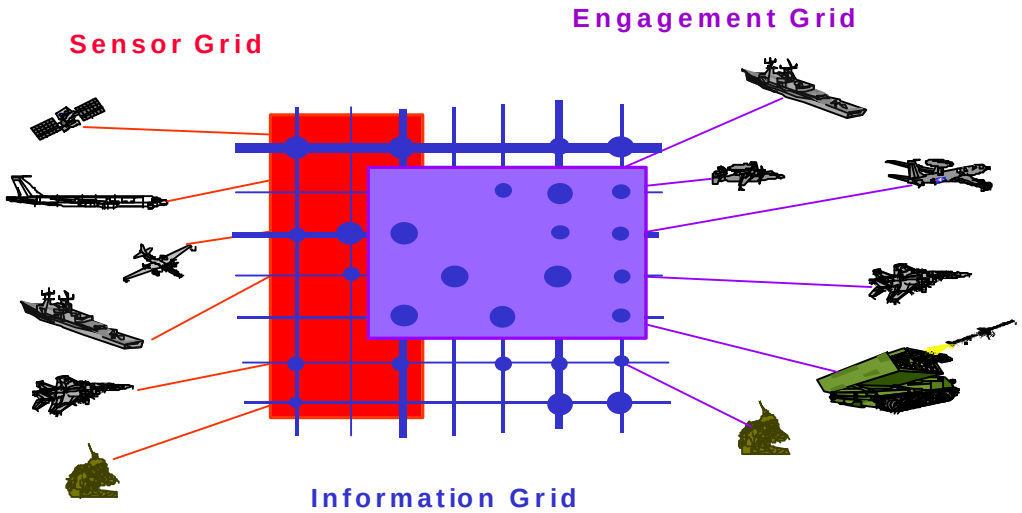

Figure 1. Three Grids Comprising Information Superiority Network[2]

United States Government (USG) obtain a guarantee for reliable delivery of the products in time of crisis. The answers to these questions form the basis for this paper's thesis: the DOD has no choice but to rely heavily on the commercial space sector and can guarantee warfighters' requirements are met in time of crisis by using appropriate acquisition approaches.

Trends Driving the Military to Rely on the Commercial Space Sector

The first step in answering the research question is to understand the trends driving the military's reliance on the commercial space sector. These trends include the expanded role of space assets in the military's vision for future combat, DOD acquisition reforms, and the commercial space sector's explosive growth

The US military's vision of future combat requires achieving Information Superiority by exploiting the global information infrastructure. The global information infrastructure is comprised of voice communication, data communication, information service, and interactive service providers around the globe. It follows that a portion of the military requirements must be met by commercial sources since much of this infrastructure uses commercial space systems and the military must use the infrastructure to achieve the Information Superiority network. Network services, communications, and intelligence collection are examples of military requirements being met by the commercial space sector.

A second trend inside the DOD is acquisition reform. Acquisition reform initiatives are designed to leverage efficiencies in the commercial sector to save the DOD money, reduce the acquisition cycle of military systems, and provide users better systems. In fact, all acquisition decision-makers must investigate the procurement, including modification, of commercially available systems or equipment *before* initiating a new program.[3]

The explosive growth in the commercial space sector is a third trend and is affecting the military in two ways. First, the commercial sector's growth has effectively caused the technology leadership role to transition from the military to industry. Commercial research and development (R&D) efforts have demonstrated this leadership by producing several technical breakthroughs in the space imagery, global communications, and global

networking arenas. The military must leverage them to maintain its technical prowess. Second, growing demand for space-based services is driving the commercial space sector to build entire satellite constellations. This clearly demonstrates use of space-based assets has transitioned from a purely military domain to a shared military and industry environment. DOD influence over the commercial systems will diminish as the market expands because profit motives not national security interests drive the commercial systems. The end result cannot be ignored—industry has become the technology leader and is building a global information infrastructure. Despite its waning influence, the military must take advantage of this opportunity and exploit this infrastructure to fully achieve Information Superiority. Chapter 2 provides detailed arguments answering why the DOD must rely on the commercial space sector to meet critical requirements.

Meeting Military Requirements with Commercial Sources

After accepting the military must rely on the commercial space sector to meet critical military requirements, the next step in answering the research question is to examine the requirements being met with commercial sources. Two military requirements, being met by the commercial space imagery and communications sectors, are examined in-depth because they form the basis of the Information Superiority network. These requirements are defined in chapter 3 and general requirements to reduce the risk of relying on the commercial sector are provided in chapter 4.

Acquisition Approaches to Meet Military Requirements with Commercial Sources

The thesis states the DOD can reliably guarantee delivery of commercial services by selecting an appropriate acquisition approach. The methodology used to select this

approach is to first identify the requirements, accomplished in chapters 3 and 4, define evaluation criteria and competing acquisition approaches, and finally compare the approaches using the evaluation criteria. Chapter 5 presents the evaluation criteria, compares six acquisition approaches, and provides conclusions and recommendations regarding their ability to meet the military requirements. Finally, a summary of the argument, conclusions, and recommendations is provided in chapter 6.

Project Limitations

This research project faces two limitations. First, some military requirements cannot be met by the commercial sector. Transmitting sensitive government communications, operating in a nuclear stressed environment, and collecting highly classified information all drive requirements that can be met only with government systems. The scope of this project is limited to those requirements that *can* be met in the commercial sector. The current acquisition environment, which often prevents the DOD from using new and innovative acquisition approaches, imposes a second limitation. Implementation of these innovations requires overcoming complex rules for competition, breaking traditional aversions to venture capital risk, and learning to accept commercial business practices like joint ownership and seed money. This project focuses on finding the solution to guarantee delivery of critical commercial space products and in the process examines both traditional and innovative acquisition approaches. In light of these limitations, the author acknowledges the selection of an innovative approach may require both the development of unfamiliar acquisition techniques, and regulatory and legislative approval.

Notes

[1] Briefing, Senior Warfighters Forum IV, subject: Information Superiority and the Demand for High-Speed, High-Capacity Comms, Network Centric Warfare slide, n.d., 16.

[2] Ibid.

[3] Department of Defense Directive (DODD) 5000.1, *Defense Acquisition,* 15 Mar 1996, 6.

Chapter 2

Trends Driving the Military to Rely on the Commercial Space Sector

> *Know thy enemy and know thyself; in a hundred battles thy will never be in peril.*
>
> —Sun Tzu

To know the enemy and yourself in the Information Age requires an ability to collect, process, analyze, and distribute information to decision makers faster than an opponent in order to win in battle. This concept is driving the military to exploit the global information infrastructure to achieve Information Superiority. The military's reliance on space is also increasing because both government and commercial elements of this information infrastructure are migrating to space platforms. Additionally, the military must rely on commercial portions of the infrastructure because building a purely military infrastructure is too expensive for the DOD in an era of shrinking budgets. A second trend driving the military's reliance on the commercial sector is the DOD acquisition reform initiatives to save money, cut acquisition cycle times, and provide users better products. The commercial sector's breakneck expansion of its space segment to meet the marketplace needs is a third trend driving the military to rely on the commercial sector. This chapter examines each trend in detail to understand why the military must rely on the commercial space sector to meet critical requirements.

Military Trends Affecting Use of Commercial Space Sector

Since the beginning of the space age, warfighters have realized space assets could be used to collect and distribute information to decision makers. This concept evolved to a new level several years ago—from individual space segments into a network of space assets. In 1994, the *Spacecast 2020* study concluded knowledge gained from space would enable tomorrow's decision maker to increase the quantity of supporting information, the speed, and the quality of decisions at all levels of command.[1] The study forecasted a "demand information architecture" enabled by the growth of space.[2] In this architecture, decision makers at all levels would "pull-down" required information vice the traditional system where decisions are made with only information "pushed-down" to decision makers.[3] This transition to a pull-down architecture was the first step in realizing the Information Superiority concept.

Information Superiority Requires Use of Commercial Space Sector

The vision of space-based, global information networks expands this concept further and inherently requires a heavy reliance on commercial assets to perform this function. In Sep 97, the Senior Warfighters forum (SWarF) on military satellite communications (MILSATCOM) codified the pull-down architecture by defining the Network Centric Warfare concept of Information Superiority.[4] In fact, *Joint Vision 2010* states the basis for its new conceptual framework for operations is found in improved command, control, and intelligence which can be assured by Information Superiority.[5] This concept for tomorrow's battlefield requires building several pieces of the network at the same time the commercial space sector is building numerous space-based imagery systems and communications networks to meet the needs of the commercial market. This explosion

of military requirements, coupled with the DOD budget's inability to pay for the massive development, requires the DOD to exploit commercial sector investment and incorporate its assets into the Information Superiority sensor and information grids.

Precedent for DOD Use of Commercial Space Sector

The precedent for relying on commercial assets for military purposes has already been set. Even before the Information Superiority concept, the DOD relied on the commercial space sector to augment DOD systems in a number of areas. The DOD purchased imagery collected by the French Satellite pour l'Observation de la Terre (SPOT) during DESERT STORM to augment national databases and it continues to purchase commercial imagery today.[6] The DOD also relied on commercial mobile communications to augment military systems in numerous military operations. One example is the use of International Maritime Satellite (INMARSAT) by military forces deployed to Somalia.[7]

Logically, the role of commercial assets will increase as the DOD's use of space also increases. The use of commercial communication satellites is so routine that Lt Gen Edmonds, director of Defense Information Systems Agency (DISA), stated the Pentagon "will never ever be able to afford to buy government unique satellites" in quantities to meet the projected need.[8] The impetus behind the SWarF on MILSATCOM was to develop a strategy for all future DOD communications. This general officer steering group's decision validated the idea that military requirements must be met at least in part by the commercial space sector.[9]

In summary, the DOD is beginning to rely on a new "pull-down" information network and requirements for space assets are exploding as a result. The DOD routinely

uses commercial space assets to augment DOD systems for specific missions but relying on the commercial global information infrastructure is required to make the Information Superiority vision a reality.

Acquisition Reforms Driving Use of Commercial Space Sector

DOD acquisition reforms are a second major trend fueling the use of commercial space products. The acquisition reform initiatives' basic goals are to save DOD money, reduce military acquisition cycle time, and provide users better products.

Reforms to Save Money

The shrinking DOD budget is driving several acquisition reforms to save money. The current DOD budget is 35% lower than 1986 and the current program, when adjusted for inflation, projects negative growth through the out-years.[10] Cuts of this magnitude are forcing the DOD to use acquisition reforms like military-specification reform and dual-use programs to save the few precious dollars remaining.

Military Specification Reform. The objective of military specification reform is to realize savings by employing efficient commercial practices instead of costly military unique practices. This reform breaks down barriers between the defense and commercial sectors allowing easy injection of state-of-the-art technology into military systems.[11] Another benefit is the military's ability to purchase Commercial-off-the-Shelf (COTS) equipment even though it was designed to commercial standards instead of military specifications. The end result is DOD savings and the incorporation of new technologies with little military investment.

Dual-Use Applications Reforms. Another cost-savings reform is the dual-use application of technologies and programs. Products procured in this manner are generally referred to as non-developmental items. Using dual-use technologies takes advantage of commercial innovations and developments rather than funding internal DOD R&D efforts to meet the same requirement. This leverages commercial investments in R&D, which outpace DOD investments 2 to 1.[12] Additionally, this reform transfers to commercial systems functions currently being performed by DOD systems. The Commercial Satellite Communications Initiative (CSCI) exemplifies this reform by procuring commercial satellite communications (SATCOM) instead of expanding the DOD MILSATCOM network.[13] The initiative to meet DOD mission requirements for weather information using National Oceanic Atmospheric Agency (NOAA) satellites and the European Organization for the Exploitation of Meteorological Satellites is another example of this reform.[14]

Reforms to Reduce Acquisition Cycle Time

Acquisition cycle time is the time it takes to develop and procure a military system. This reform takes advantage of commercial acquisition cycle times of three to four years versus the typical DOD cycle time of fifteen years.[15] The goal is to incorporate emerging technologies into military systems quicker than the normal DOD cycle allows.

The Advanced Concept Technology Demonstration (ACTD) concept is a complementary reform. This initiative provides the structure for a direct demonstration of mature advanced technology into field tests to measure if it "meets" military requirements. When successful this initiative shaves years off the acquisition cycle time while allowing users to incorporate new technologies into new or existing concepts.[16]

Commercial Trends in the Space Market

The military drive to use commercial space assets to achieve Information Superiority and DOD acquisition reforms are two trends pushing the military to rely heavily on the commercial space sector. Concurrently, the commercial market is exploding to meet commercial needs with the new global information infrastructure. The commercial sector's growth is affecting the DOD in two ways. First, the military is becoming reliant on commercial technology innovations since industry has become the technology leader. A second affect is the reduction of DOD influence in the global marketplace.

Industry as the New Technology Leader

A significant impact of the exploding commercial market is industry's new role as technology leader. The Air Force Scientific Advisory Board (AFSAB) acknowledged the entertainment industry's leading position in the areas of computers and information science—the basis of the information infrastructure.[17] In other commercial endeavors, the Department of Commerce (DOC) is helping industry to grow quickly to maintain the US leadership role in the global marketplace. One area where the DOC goal is impacting the DOD is commercial imagery. Imagery companies project the market will grow to about 10% of the $100-200B global information market.[18] While it is a recognized fact the US holds the technological edge in space imaging, the expertise is maintained inside the DOD and with its contractors.[19] As the DOC goal is achieved, the technology edge will transfer from the DOD to industry following the pattern set by the information technologies. In addition to developing new technologies, industry is building systems with the ability to incorporate new technologies throughout their design life. This ability to adapt, or *adaptability*, allows industry to continually improve its systems and maintain

its market edge. The DOD must consider the *adaptability* of a commercial system as it begins to rely on industry to meet military requirements. As industry establishes the leading edge and builds adaptable systems, the DOD can either take advantage of these opportunities or develop technologies to keep pace on its own.

Unfortunately the DOD budget's negative growth makes it clear it cannot afford to develop technology in all sectors of the global information infrastructure and must rely on industry as the technology leader. This allows the DOD to take advantage of commercial technology in common areas and wisely apply its limited investment dollars in military unique sectors. In summary, the key to capitalizing on technical innovations is to understand the market trends and ride the wave of opportunity to stay on the leading edge and gain Information Superiority.

Diminished DOD Influence

A second affect of the commercial sector's explosive growth is the transition from DOD to industry control of the information infrastructure. This process significantly diminishes the DOD influence on the global market. The *Spacecast 2020* study recognized space as a potential area for commercial exploitation and industry is making this prediction a reality.[20] The DOC estimates non-military, commercial space activities generated almost $7.5B in revenue in 1995 and is growing steadily.[21] A Silicon Valley firm's recruiting slogan, "*Reinventing Telephony…Come and be part of our future as we reinvent the world of telecommunications"* epitomizes an expanding industry reinventing worldwide communications.[22] The commercial sector's expansions into electro-optical and synthetic aperture radar (SAR) imagery are examples this trend is not limited to communications. In addition, the new information infrastructure's reliance on space-

based platforms is causing the military to regard commercial assets differently.[23] All of this evidence points to an industry responding to market forces, not to DOD influence.

Industry achieved this position with considerable US government assistance. The government encouraged industry to grow quickly to maintain the global market leadership role. There are many examples of congressional pressure on the DOD to use the commercial space sector to help achieve this. The Senate Armed Services Committee sent language to the department urging it to leverage the commercial SATCOM market with the goal of cost savings. The language recommended innovative acquisition techniques like joint ownership with the commercial sector.[24] The DOD initiatives to exploit the marketplace took root in several areas; National Imagery and Mapping Agency's (NIMA) commercial office and DISA's CSCI program are two examples. Outside the DOD, the DOC is working to expand the commercial sector's role in space. Much of their effort is in the imagery arena. The 1994 Presidential Decision Directive 23 (PDD23) goal is to support and enhance US industrial competitiveness in remote sensing space capabilities while protecting US national security and foreign policy interests.[25]

Despite the government's role in "growing" the commercial industry, DOD influence on the market has diminished. This is due to the decreasing portion of the market share purchased by the DOD while the overall market explodes to meet the demands of the commercial users. Since the market is driven by profits it follows that DOD influence decreases as its portion of the market declines despite the government's role in expanding the market.

Summary

The vision of Information Superiority, acquisition reform initiatives, and the explosion of the commercial space marketplace dictate the DOD must rely on commercial systems to conduct current military operations and to achieve the *Joint Vision 2010* goal for future operations. The trends also inherently fuel an emphasis on acquisition approaches that value cost savings and shorter acquisition times while taking advantage of the commercial systems' adaptability to incorporate emerging technical innovations.

Notes

[1] Air University, *Spacecast 2020-Into the Future, Executive Summary* (Maxwell AFB, Ala.: Air Education and Training Command, 23 June 1994), 4.

[2] Ibid, 7.

[3] Air University, *Spacecast 2020-Into the Future, Executive Summary*, 7. According to the Spacecast 2020 report, "push-down" and "pull-down" systems are differentiated by the direction of requests for information. An alternative way of describing the concept is by "demand" and "command" information systems. Command systems evolved during the Cold War when the principal threat was restricted to generally a single geographical area. Information was processed at a central location (primarily due to the costly, large main-frame computers required to do the job) and then sent out to lower-echelon units at the command of higher level commanders, i.e. a command system is top down. Demand systems are based on bottom up requests. The field commander "pulls-down" the information *needed* instead of being provided with the information "pushed-down" via the decisions of others.

[4] Briefing, Senior Warfighters Forum IV, subject: Information Superiority and The Demand for High-Speed, High-Capacity Comms, Network Centric Warfare slide, n.d., 16.

[5] Department of Defense Pamphlet (photocopy), *Joint Vision 2010*, n.d., 12-13.

[6] G. J. Tahu, J. C. Baker, and K. O'Connell, "Expanding Global Access to Civilian and Commercial Remote Sensing Systems and Data: Implications and Policy Issues" (American Institute of Aeronautics and Astronautics paper), 1997, 7. According to Tahu et al, SPOT was used during DESERT STORM to augment the national databases. According to Joseph Anselmo, the DOD continues to purchase commercial imagery today. See Joseph C. Anselmo, "Commercial Satellites Zoom In on Military Imagery Monopoly," *Aviation Week & Space Technology*, 22 Sep 1997, 75.

[7] Col Roy Block, Steve Miller, and Dick Schonberger, Defense Information Systems Agency, interviewed by author, Arlington, Virg., 12 Dec 1997.

Notes

[8] "DOD Eyes Commercial Satellites," *Navy Times* 44, no. 38 (26 Jun 1995): 26.

[9] VADM Bien, United States Space Command, Senior Warfighter's Forum IV, briefing, subject: Advanced MILSATCOM "A Report Out," 15 Aug 1997, 6.

[10] Lt Col Mark Browne, "Planning, Programming and Budgeting System," lecture, Air Command and Staff College, Maxwell AFB, Ala., 27 Jan 1998.

[11] House, *Under Secretary of Defense for Acquisition and Technology statement on Defense Acquisition Reform, Honorable Paul G. Kaminski: Hearings before the Committee on National Security*, 105th Cong., 1st sess., 26 Feb 1997.

[12] House, *Defense Acquisition Reform*, 26 Feb 1997.

[13] House, *Under Secretary of Defense for Acquisition and Technology statement on FY 1996 DOD Space Program, Honorable Paul G. Kaminski: Hearings before the Appropriation Committee, National Security Subcommittee*, 104th Cong., 1st sess., 23 Mar 1995.

[14] House, *FY96 DOD Space Program*, 23 Mar 1995.

[15] House, *Defense Acquisition Reform*, 26 Feb 1997.

[16] House, *Defense Acquisition Reform*, 26 Feb 1997.

[17] Air Force Scientific Advisory Board, *New World Vistas: Air and Space Power for the 21st Century, Summary Volume*, (Maxwell AFB, Ala.: Air Education and Training Command, 15 Dec 1995), 51.

[18] Briefing, Center for Information Revolution Analysis, RAND, subject: Emerging Markets of the Information Age: A Case Study in Remote Sensing Data and Technology, Feb 1996, 35.

[19] Jay Rixse, National Reconnaissance Office, interviewed by author, Washington, D.C., 11 Dec 97.

[20] Air University, *Spacecast 2020-Into the Future, Executive Summary*, 4.

[21] House, *Promoting Commercial Space Activity, Statement of Scott Pace, Ph.D., RAND Corporation: Hearings before the Subcommittee on Space and Aeronautics*, 104th Cong., 2nd sess., 31 Jul 1996.

[22] "Cidco Advertisement," *Westech's High Technology Careers* 15, no. 1W (Feb 1998): 107.

[23] Lt Gen Lance Lord, AFSPACE/CV, "Role of Space," lecture, Air Command and Staff College, Maxwell AFB, Ala., Nov 1997. According to General Lord, the senior USAF leadership has begun to realize the significant role commercial space assets play in the economy of the US. He refers to space as one of "America's economic centers of gravity." The explosion of commercial space and the military's reliance upon it is changing how the military views its own information architecture. Gen Lord went on to state the military needs to be prepared to control and protect the commercial space assets or centers of gravity.

[24] Senate Armed Services Committee, *FY98 SASC Space Related Language, Title X, General Provisions, Subtitle E-Other Matters, Other Items of Interest*, 105th Cong., 1st sess., n.d.

[25] President, Decision Directive 23, "US Policy on Foreign Access to Remote Sensing Space Capabilities," 1994.

Chapter 3

Meeting Military Requirements with Commercial Sources

> *Improvements in information and systems integration technologies will also significantly impact future military operations by providing decision makers with accurate information in a timely manner.*
>
> *—Joint Vision 2010*

The current trends discussed earlier are driving the DOD to meet many military requirements by using commercial space assets and networks. This chapter addresses two critical military requirements being met by the commercial sector at a rapid pace—imagery and communications.

Commercial Imagery

There are many military applications for commercial imagery. Historically, imagery was used solely for strategic intelligence purposes. Today military applications include surveillance, reconnaissance, tactical intelligence, battle damage assessment, and geospatial information. The proliferation of applications is driving a significant increase in all types of imagery requirements.

Current Use

Current military requirements are managed by NIMA, a US government clearinghouse. NIMA fills military requirements using imagery obtained by National

Technical Means (NTM) and more recently through commercial sources. For instance, last year NIMA purchased $2.5M of radar and electro-optical imagery from commercial vendors.[1] Another NIMA estimate put the annual DOD expenditure at the $3-4M level with the combined total of DOD, USG agencies, and intelligence community expenditures between $9-11M.[2] NIMA also supervised the development of the Commercial Satellite Image Library (CSIL) at the Defense Intelligence Agency (DIA) headquarters which stores imagery obtained from commercial sources. As of Jul 97, CSIL had over 3950 digital images on file.[3] These numbers indicate the current military requirement for commercial imagery is several thousand images per year equating to approximately $3.5M annually.

Projected Use

The military requirements for imagery are growing significantly. The Information Superiority vision is fueling imagery requirements for many tactical purposes including worldwide map making. The AFSAB highlighted the role commercial providers will fill to develop a 1-meter resolution world map.[4] The map will be used to feed combat planning systems for the entire world. Robert Steele, a private citizen monitoring open source information on imagery issues, states warfighters are unprepared for many operations because they lack current maps and images.[5] Senior USG officials proclaimed "commercial systems may meet greater than 50% of the government's requirements in the future."[6] In addition, industry's $1B investment in commercial imaging is fueling the emergence of new capabilities such as hyper-spectral, multi-spectral and radar imagery.[7] Initiatives taking advantage of these new capabilities are driving the military projections for use in this sector.

An official estimate of the military's projected commercial imagery use is hard to determine largely because the portions met by USG sources and commercial sources are not differentiated. In fact, NIMA officials are reluctant to state what their forecasted expenditures for commercial imagery are despite acknowledging it will be used to augment NTM and they are actively cultivating customer-supplier relationships.[8] What is important is commercial imagery will be used to meet military requirements for both intelligence functions and mapping in the future.[9]

Summarized Imagery Requirements

The DOD will rely on the commercial space sector to meet imagery requirements for intelligence and mapping purposes by taking advantage of commercial satellites and industry's technical innovations. The current expenditure for these commercial products is approximately $3.5M and is expected to grow to be as much as 50% of the total military expenditure for imagery. Any acquisition approach selected to provide commercial imagery must be robust enough to meet the quality and capacity requirements inherent in this level of projected use.

Commercial Communications

The communications market is a complex collection of satellites and terrestrial systems rapidly evolving to meet the new global information infrastructure needs. Many of the military requirements are met using two types of satellite systems: fixed satellite service (FSS) and mobile satellite service (MSS).[10] These systems transmit two distinct types of information—core and general purpose (GP).[11] The basic difference between the two is core information is high priority and typically used to command and control

military forces while GP information is less critical and has a lower time-sensitivity requirement. In addition, core information is normally transmitted using DOD systems incorporating military unique requirements like nuclear survivability.

Current Use

Communications requirements are measured in the speed and capacity in which data is transmitted, typically gigabits per second (Gbps). The 1997 Joint Staff/Communications division (JS/6) estimate for all DOD communications was 2 Gbps while the General Accounting Office (GAO) estimates the requirement to be 1.729 Gbps.[12] By comparison, the total capacity of the Defense Satellite Communication System (DSCS) constellation in 1998 is approximately 0.6 Gbps.[13] However, the portion of these estimates met by commercial space systems is difficult to quantify for several reasons. First, the allocation between terrestrial and space systems is not clearly documented. A DISA rule of thumb is one-third of communications is transmitted on terrestrial systems, one-third on DOD satellites, and one-third on commercial systems.[14]

A second difficulty in quantifying the military's current use of commercial space communication systems is dividing the information into core and GP categories. This is important because the GP category is the portion suitable to be met with commercial systems. DISA, chartered as the clearinghouse for all DOD communication requirements, established the CSCI program to leverage the commercial sector to help meet GP requirements. However, the capacity procured from commercial sources does not include all of the GP requirements for two reasons: 1) some GP information is transmitted using DOD systems, and 2) many military units procure commercial service

outside DISA channels.[15] With these difficulties in mind, an estimate of the current military use of commercial space systems is 0.5 Gbps.

Projected Use

Like imagery, the projected requirement for communications is difficult to calculate. The Information Superiority vision is pushing military units at all levels to increase their communication requirements. In addition, new applications are being developed to take advantage of commercial systems. Two currently in development are the incorporation of a global "cellular phone" in survival kits, and two-way, on-the-move communications between deployed troops on the battlefield.[16] Also, commercial systems are being used to augment host nation infrastructure during operations other than war. MSS systems were used in Somalia during the humanitarian operations and transportable terminals were deployed during OPERATION JUST CAUSE.[17]

The total JS/6 estimate for military communications in 2007 is 9.5 Gbps with 5.5 Gbps being GP information and 4.0 Gbps core.[18] The GP portion allocated to commercial sources is unknown but the MILSATCOM master plan recommends using commercial satellites for a significant portion of GP communications by 2000.[19] Estimates for the portion being met by commercial vendors thus ranges between 1.8 and 5.5 Gbps.

Summarized Communication Requirements

The DOD will rely on the commercial sector to meet GP communication requirements to take advantage of commercial systems' capacity and industry's technical

innovations. Currently, DOD estimates 0.5 Gbps are procured through commercial sources and this is projected to grow well beyond 1.8 Gbps by 2007.[20]

The aggregate imagery and communications requirements demonstrate the military is relying on the commercial sector to provide substantial products and services. These requirements must drive acquisition approaches to ensure the users receive the required services both in the quantity required and of sufficient quality. An acquisition approach ignoring these factors will never meet the requirements it was designed for.

Notes

[1] Joseph C. Anselmo, "Commercial Satellites Zoom In on Military Imagery Monopoly," *Aviation Week & Space Technology*, 22 Sep 1997, 75. According to Anselmo, NIMA purchased $977K from SPOT, electro-optical (EO) Imagery; $903K from Radarsat, radar imagery; and $521K from Landsat, EO imagery.

[2] Randy Ferryman, National Imagery and Mapping Agency, briefing, subject: Commercial Satellite Imagery, 24 Nov 97, 4.

[3] Thomas O'Brien, "Commercial Satellite Image Library Open for Business," *Communique* 9, no. 4 (Jun/Jul 1997): 43.

[4] Air Force Scientific Advisory Board, *New World Vistas: Air and Space Power for the 21st Century, Summary Volume*, staff study, 15 Dec 1995, 19.

[5] Robert Steele, "Requirements, Resolution, and Reality: Uniformed Policy Means Unprepared Warfighters, Blind Diplomacy, and Bad Business" (paper presented to Third Congress of the National Remote Sensing Industry Association, 22 May 1997), 2. Steele studied the imagery and maps for sixty-nine countries and found there was a substantial shortfall in the currency of maps for joint operations planning. He concluded contingency plans are not supportable due to the lack of current maps.

[6] Contractor whitepaper, USSPACECOM, "Alternatives for Integrating Commercial High Resolution Imaging Satellites in the Future Architecture," Nov 97, 3.

[7] Ibid, 8.

[8] Randy Ferryman and Clay Ancell, National Imagery and Mapping Agency, interviewed by author, Arlington, Virg., 10 Dec 1997.

[9] National Imagery and Mapping Agency, *Commercial Satellite Imagery Concept of Operations,* (Washington, D.C., May 1997), 2, 8. NIMA's concept of operations (system's operational concept) for the future is based on the following: there will be an increase in the use of commercial imagery and commercial imagery will serve to supplement and complement national imagery.

[10] Ropelewski, Robert, "Satellite Services Soar," *Aerospace America* 34, no. 11 (Nov 1996): 26-31. According to Ropelewski there are two basic types of communications systems. The mainstay of satellite communications is fixed satellite service (FSS)—geo-stationary satellites linked to fixed ground sites. The Defense Satellite Communication

System (DSCS) and INTELSAT are examples. Fixed satellite service is now being challenged by a new type of system where smaller satellites at a much lower altitude are linked together to provide a network to provide continuous communication service. This is called mobile satellite service (MSS) and does not require the user to use a fixed ground terminal to communicate. With MSS, the customer uses a transportable handset instead of a fixed ground terminal. MSS systems operate in a Low Earth Orbit (LEO) partly to keep the handset power requirements low. MSS systems are capable of meeting many communications requirements including mobile telephone, paging, low rate data communications, interactive communications and video-teleconferencing. LEO systems further break down into three categories: Big LEO: (1-2 Ghz) voice and data comm i.e. mobile telephone; Little LEO: (below 1 Ghz) data comm, i.e. e-mail. paging; and Broadband LEO: (Ka high bandwidth comm, i.e. video teleconferencing (VTC), voice and high-speed data.

[11] There are two basic types of information transmitted through communications systems used by the military. The military breaks information transmitted through communications systems into two categories: Core and General Purpose. Core information is high priority and is typically used to command and control military forces. Systems transmitting core information incorporate costly military unique requirements (MUR) like anti-jamming and scintillation protection to ensure communications at all times in a stressed environment. General purpose (GP) information is less critical and has a lower time-sensitivity requirement. Systems transmitting GP information do not include design features to transmit in a nuclear stressed environment.

[12] General Bucholz, Joint Staff/JS6, briefing, subject: SATCOM Support to the Warfighter, 7 Oct 97. See briefing for JS6 estimate. GAO estimate is according to United States General Accounting Office, *Report to the Congress: Military Satellite Communications, DOD Needs to Review Requirements and Strengthen Leasing Practices*, (Washington, D.C.: General Accounting Office, February 1994), 5.

[13] Bucholz, SATCOM Support to the Warfighter, 7 Oct 97.

[14] Deborah R. Castleman et al, *US Army Communications Using Commercial Satellites*, (Arroyo Center, Santa Monica, Calif.: RAND, n.d.), 7.

[15] Col Roy Block, Steve Miller, and Dick Schonberger, Defense Information Systems Agency, interviewed by author, Arlington, Virg., 12 Dec 1997.

[16] Brig Gen John Clay, AFMC/SMC/CV, interviewed by author, Maxwell AFB, Ala.,10 Nov 1997.

[17] Col Roy Block, Steve Miller, and Dick Schonberger, Defense Information Systems Agency, interviewed by author, Arlington, Virg., 12 Dec 1997. According to Block et al, MSS systems were used in Somalia. According to Castleman, et al, Alascom transportable systems were used during JUST CAUSE. Castleman, *US Army Communications Using Commercial Satellites*, 7.

[18] Bucholz, SATCOM Support to the Warfighter, 7 Oct 97.

[19] "DOD Eyes Commercial Satellites," *Navy Times* 44, no. 38 (26 Jun 1995): 26.

Chapter 4

Reducing Risks of Relying on the Commercial Space Sector

> *INMARSAT oversubscribed and CNN locked us out. We had to make a call at early each morning and leave the channel open all day just to ensure we could make a 10 minute call at noon.*
>
> —Senior Communications Officer
> during Somalian Operation

Military use of commercial systems to meet its requirements includes several risks. Loss of control of the asset and inability to meet military unique requirements (MUR) are the two most significant and must be addressed in the system's operational concept. A system's operational concept describes what the system will provide to the users, how it will be provided, when it will be provided, to whom, and by whom. Typically, operational concepts break the system into components and answer the same questions for each component. It provides an overall picture of the players and their responsibilities in support of the military operation.[1] This chapter discusses these risks and provides methods to reduce the risk of each.

DOD System Control

The historical DOD operational concept for supporting deployed forces with space assets is based on the DOD operating its own space systems. This operational concept inherently provides the military with full control of the assets. Relying on commercially

owned assets reduces the amount of control the military has in terms of guaranteed service and the timeliness of delivery.

The disruption in delivery of SPOT imagery to Iraq during DESERT STORM is an example where the Iraqi military's lack of system control resulted in a failure to meet critical requirements with commercial sources.[2] Another type of loss of control occurs when competing values pit the military and national security against a commercial venture and the profit motive. The recent attack on the Global Positioning System (GPS) frequency spectrum by the INMARSAT consortium exemplifies how economic interests compete with the military for control of space systems.[3]

Oversubscription is another risk encountered when relying on commercial vendors. During the Somalian humanitarian operation, INMARSAT oversubscribed and the military found itself competing with the media and other customers for the few circuits in that remote region of the world.[4] This exemplifies the risk of a vendor not providing a high degree of reliable delivery timeliness.

Joint military and commercial ownership of a system substantially reduces this risk from a military perspective. Just as full ownership translates to full system control, a system's operational concept employing joint ownership allows the military to gain limited control. Small, start-up companies often look to the DOD for government involvement because this type of relationship provides the company a stable funding stream and allows the company to gain venture capital. This opens the door for the DOD to gain limited control over a system by forming a partnership early in the system's development. Table 1 shows a sample of commercial imaging satellite companies attempting to gain a foothold in the commercial market that could potentially benefit

from DOD partnership. From the military perspective, an operational concept based on joint ownership enables the DOD to influence how the system is operated. This provides a risk reduction method to address loss of control but commercial systems' inability to meet MURs is another major risk that must be addressed.

Table 1. Sample of US Commercial Imagery Providers[5]

Company	System	Product
Space Imaging, Inc.	Commercial Remote Sensing System (CRSS)	0.8 meter Panchromatic 3.2 meter Multi-spectral (MSI)
Earth Watch, Inc.	Early Bird Quick Bird	3.0 meter Panchromatic 15 meter MSI 0.8 meter Panchromatic 3.2 meter MSI
Orbimage Corporation	OrbView	1-2 meter Panchromatic 4 meter MSI

Military Unique Requirements

The inability of commercial systems to meet MURs such as data protection, global access, relative affordability, and physical protection of commercial assets is another risk the military must address when using commercial systems.

Data protection

Military communications have unique requirements for protecting both data content and transmitter location. Designs of some MSS systems provide a partial solution to these requirements and inherently offer a risk reduction method. For instance, multiple satellite links, variable power control, and redundant satellite cross-linking all contribute to a level of anti-jamming capability which protects the ability to transmit data.[6] Designs incorporating minimal radiated power handsets and directional antennas offer a partial

solution to the low probability of intercept/low probability of detection (LPI/LPD) requirement to protect the location of the transmitter.[7]

Global access

The military requires complete global access and the commercial space sector may have difficulty meeting this requirement. Some commercial satellites perform housekeeping functions during the polar or open-ocean phase of their orbit, taking them out of service.[8] One method to reduce this risk is to ensure the operational concept takes into account limitations of this type. The inability of commercial systems to meet this MUR may be offset by augmenting them with DOD systems.

Relative Affordability

Commercial practices may make some military applications unaffordable. Incorporating cellular phones in aircrew survival kits is an example. Typically, cell phone companies charge a service fee per phone every month whether a user uses the phone or not. The survival kit application requires thousands of cellular phones with most never being used and unnecessary system costs would be incurred. Tailoring commercial practices to meet this MUR is a method to reduce this risk.

Physical protection of commercial assets

Commercial ground and space elements are more vulnerable to physical attack because they are not routinely protected like their military counterparts. However, in some cases, the entire commercial ground segment is located in the continental US (CONUS) attaining an inherent degree of protection.[9] The military may find this offers enough protection to reduce the vulnerability risks to an acceptable level.

An additional aspect of this risk is the potential for both friendly and enemy use of a commercial system during a conflict. Destroying a commercial ground site used by enemy forces would be counterproductive if friendly forces also used it. Joint doctrine calls for space control as part of any campaign plan but attaining space control when both friendly and enemy forces use the same commercial system or network is difficult.[10] Thus, both enemy and friendly use of commercial systems offers an inherent level of protection.

Summarized Risk Reduction Requirements

The military requires a high level of reliability for any system supporting military operations—commercial or DOD owned. Joint ownership increases the DOD level of control and reduces the risks of not receiving required services and unacceptable timeliness of delivery. Incorporating a commercial system design and/or operational concept's inherent ability to meet some level of MURs is another method to reduce the risk of relying on the commercial sector to meet critical military requirements. Both reliability and the ability to meet some level of MURs must be addressed by a candidate acquisition approach if it is intended to meet military requirements.

Notes

[1] Department of Defense, *Glossary: Defense Acquisition Acronyms & Terms*, (Washington, D.C.: US Government Printing Office, 1991), B-75.

[2] G. J. Tahu, J. C. Baker, and K. O'Connell, "Expanding Global Access to Civilian and Commercial Remote Sensing Systems and Data: Implications and Policy Issues" (American Institute of Aeronautics and Astronautics paper), 1997, 7.

[3] Scott Pace, RAND, interviewed by author, Washington, D.C., 11 Dec 1997. According to S. Pace, International consortiums plotted to gain a majority of votes during the World Radio Communications (WRC) Conference to allow the sell-off of portions of the GPS spectrum. The direct beneficiary was INMARSAT. DOD foreknowledge of the attack was scant and only through significant lobbying and compromise was the deal

scuttled. The lesson learned from the experience is the DOD needs to work in concert with the other USG agencies to ensure the commercial sector's requests are fully analyzed from a national security perspective.

[4] Col Roy Block, Steve Miller, and Dick Schonberger, Defense Information Service Agency, interviewed by author, Arlington, Virg., 12 Dec 1997.

[5] J.R. Batzler, CNA, briefing, subject: Commercial Imagery Options: Leveraging Commercial Imagery for use by DOD and the Civil Federal Government in Support of National Security, 22 Nov 1996, 13.

[6] Deborah R. Castleman et al, *US Army Communications Using Commercial Satellites*, (Arroyo Center, Santa Monica, Calif.: RAND, n.d.), 9.

[7] Briefing, Defense Information Systems Agency, subject: DOD Use of Mobile Satellite Systems, n.d., 36.

[8] Brig Gen John Clay, AFMC/SMC/CV, interviewed by Maxwell AFB, Ala., 10 Nov1997.

[9] Larry Franklin, *An Analysis of the Orbcomm Commercial Satellite System for Possible Military Use*, Naval Postgraduate School, Research Report no. AD-B187 913, June 1994.

[10] Department of Defense, Joint Pub 1, *Joint Warfare of the Armed Forces of the United States*, 10 Jan 95, IV-7.

Chapter 5

Acquisition Approaches to Meet Military Requirements with Commercial Sources

> *We cannot lose sight of the fact that the acquisition system is not an end in itself—that it was created to serve one purpose: to meet the warfighters' needs.*
>
> —Honorable Colleen Preston
> *Former Deputy Under Secretary of Defense for Acquisition Reform*

The DOD acquisition system is comprised of many programs, all designed with the fundamental purpose of meeting warfighters' needs or requirements. Each program is built on a comprehensive, integrated strategy, or acquisition approach, dictating how the program will meet a military requirement.[1] The acquisition approach must dovetail with the system's operational concept because it defines the procurement of the components and services comprising the system. Different approaches are evaluated by breaking the military requirements into its important factors. Evaluation criteria are then written for varying performance levels against these factors. Finally, this criteria is used to evaluate competing acquisition approaches to find an optimal solution.

Meeting military requirements using commercial systems is changing the traditional DOD basis for evaluating competing acquisition approaches. Evaluations now emphasize a system's *adaptability* to continually incorporate commercial technology advancements and its *reliability* to deliver services on time. These factors combined with

the traditional factors of *cost* and *performance* form the basis for evaluating competing acquisition approaches. This chapter follows this methodology to select an approach to meet military requirements by defining the evaluation criteria and competing acquisition approaches, then comparing the approaches using the evaluation criteria, and finally providing conclusions and recommendations regarding their ability to meet military requirements.

Acquisition Approach Considerations

Selecting a particular acquisition approach is done by evaluating several key factors—adaptability, reliability, cost and performance—all of which are determined, at least partially, by the system's operational concept. This section describes these factors and how they are used to evaluate competing acquisition approaches.

Adaptability

A primary reason the military is using the commercial sector to meet military requirements is to leverage commercial technical innovations. The adaptability of an approach to incorporate these emerging commercial technologies and take advantage of the short acquisition cycles best meets this goal. The optimal approach is based on an operational concept able to continually improve the system by adapting new technologies led by market innovations and in the process provides the military with state-of-the art technology.

Reliability

An approach's ability to reliably provide the warfighter commercial products is a function of two aspects: 1) level of DOD control, and 2) vendor ability to provide services on time.

Level of DOD control. Acquisition approaches gain a high level of DOD control when the DOD owns a portion of the system and has a voice in its operation. In fact, a DOD owned system has the highest reliability. Any approach selected must ensure the system in question is operated during peacetime just as in wartime, in other words train like you fight, to prevent the illusion of DOD control when it does not really exist. The US Navy (USN) experienced the problems of illusory "paper" control with the merchant marine fleet during DESERT STORM. The merchant marine fleet was under contract to meet the USN's wartime sea-lift requirements. However, the system was never exercised and when it was really needed it was not reliable.[2]

Acquisition approaches can also gain a level of government control through government licensing. For example, the Federal Communications Commission issues spectrum-use licenses and can impose caveats on the vendor to provide the DOD a level of control over communications systems. Additionally, the DOC grants imagery licenses requiring full USG access to the satellite down link in time of crisis.

Vendor ability to deliver services on time. From a warfighter's perspective, vendor reliability is measured in terms of capability to produce products or services and provide on-time delivery. For imagery, timeliness is measured as the elapsed time between customer order and product delivery.[3] Different acquisition approaches can drive delivery timeliness from near instantaneous using a direct down link (DDL)) to a few

weeks.[4] In the communications sector this translates into the vendor's ability to provide the channels, transponders, or data paths when needed.

Cost

The historical DOD acquisition approach is to define the requirement, then the solution, offer a solicitation and purchase that solution, and finally operate and maintain the solution throughout its lifecycle.[5] The definition of life-cycle cost (LCC) is the total government cost of acquisition, ownership and disposal of a system over its full life.[6] In this approach, the DOD inherently assumes the development risk, and owns and operates the system throughout its life-cycle. However, these basic assumptions no longer apply when products and services are procured from a commercial company because the company assumes the risks and owns the system. This change is driving significant aspects of the LCC in two areas: 1) the R&D and procurement cost area, and 2) the operations and maintenance (O&M) cost area.

R&D and Procurement. Using the commercial space sector to meet military requirements eliminates much of the DOD burden for R&D and procurement. For commercial systems, industry funds the R&D and procurement costs and assumes the risk of failure. The DOD benefits without investing a majority of R&D costs or assuming the associated risks. However, there are R&D and procurement cost concerns.

First, commercial vendors will only incorporate MURs like anti-jamming and encryption into their systems if they meet a market need. If not, the requirements will be added only if it is worthwhile to the company and if the DOD pays the R&D and modification costs. Developing a DOD/vendor relationship early in the development of a system allows incorporation of these modifications much more easily at a lower cost.

Second, the DOD procurement cost share is hard to estimate since the system's operational concept drives what components of the system, if any, the DOD will actually own. The risk of owning a piece of equipment unique to a particular commercial system also reduces the DOD flexibility in the marketplace. For instance, the DOD would likely purchase a ruggedized handset to use commercial MSS systems. The DOD then creates the risk of its "unique" handset becoming obsolete before it reaches the end of its design life. The alternative is for the DOD to change ruggedized handsets every several years like consumers typically do at a significant increase in LCC. This dilemma is what drives the "cost of ownership" trade-off—ownership ensures a level of control but it also requires the DOD to give up a level of adaptability and incur substantial procurement costs. The development of the system's operational concept needs to address these trades before decisions are made about what component the DOD will actually buy. In the example above, the best option may be to let the commercial company buy the handsets and lease them to the DOD.

Operations and Maintenance. A system's operational concept significantly drives the DOD share of O&M costs by dictating: 1) what components are operated and maintained by the DOD, if any, and 2) what portion of the workload, or functions, will be DOD responsibility. Figure 2 illustrates a range of options that can be used for a commercial imagery system. NIMA's Concept of Operations (CONOP) for imagery management, shown as option A, assigns the government with responsibility for performing most functions. In this case, the operational concept dictates the images will be maintained in the CSIL and the government will pay the O&M cost of storage and retrieval. An alternative operational concept requires the vendors to maintain their own

image databases and the USG users would access the required images from a web-page arrangement, shown as option B, taking advantage of the commercial infrastructure. User licensing is an additional O&M issue that significantly impacts the cost of imagery and resulting O&M costs.[7] These alternative O&M options demonstrate the range of DOD O&M costs for a particular system.

A system's operational concept also assigns major functional responsibilities to the DOD and commercial partners. A comprehensive approach would assign responsibilities based on which partner could perform the functions most economically. For example, if the DOD purchases extra satellites to augment a commercial constellation, substantial cost savings may be realized if the commercial partner also operates the DOD satellites. This allows the DOD to save O&M money by taking advantage of economies of scale and commercial workforce stability.

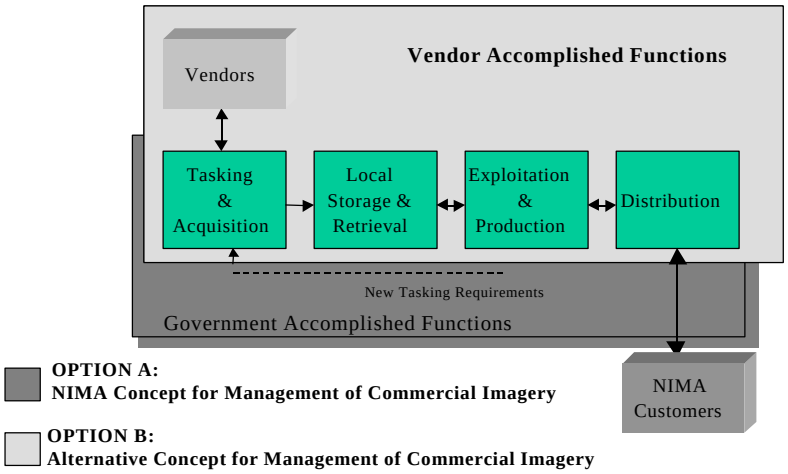

Figure 2. Concepts for Management of Commerical Imagery[8]

Like R&D and procurement, O&M cost trade-offs must carefully weigh the benefits of ownership against overall cost. The final factor, performance, is interconnected with the other factors of adaptability, reliability, and cost and is discussed next.

Performance

Product quality, *production capacity*, level of *interoperability*, and ability to incorporate *military unique requirements* are performance factors that drive the selection of an acquisition approach.

Product quality. A commercial system's ability to provide products and services of sufficient quality to meet warfighters' needs is a key performance measure. In the case of imagery, product quality of an imaging system is measured in meters of resolution. The shaded cells in Table 2 shows industry's near-term capability to meet the 1 meter resolution requirement. This level of resolution meets many of the military requirements with commercial systems.

Production Capacity. The ability of a vendor to perform at required levels is another key performance measurement. In the case of communications, production capacity is measured in bandwidth and coverage. An acquisition approach must take into account the ability to meet surge requirements, focused coverage requirements over a remote region, and unique coverage requirements like polar cap or open ocean coverage.

In the case of imagery, the primary production capacity factor is surge capacity. Commercial companies provide surge capacity in two ways. First, image analysts employed by the commercial companies represent a pool of expertise that can be readily mobilized if needed.[9] The second method of meeting surge requirements is for the military to use additional commercial satellites to increase the coverage of a crisis

region.[10] Clearly the ability or means available to meet the requirement of production capacity drives the selection of an acquisition approach.

Interoperability. The level of interoperability between the branches of the US military, allied, and coalition partners must be considered when evaluating different acquisition approaches. The military conducts operations across the full spectrum of

Table 2. Required Resolution in Meters at Which Targets Can Be Detected, Identified, Described, or Analyzed

Target	Detection[a]	General ID[b]	Precise ID[c]	Description[d]	Technical Analysis[e]
Bridges	***6***	***4.5***	***1.5***	***1***	.3
Communications					
Radar	***3***	***1***	.3	.15	.015
Radio	***3***	***1.5***	.3	.15	.015
Supply Drums	***1.5-3***	.6	.3	.03	.03
Troops Units	***6***	***2***	***1.2***	.3	.15
Airfield Facilities	***6***	***4.5***	***3***	.3	.15
Rockets and Artillery	***1***	.6	.15	.05	.145
Aircraft	***4.5***	***1.5***	***1***	.15	.145
C2 Headquarters	***3***	***1.5***	***1***	.15	.09
Missile Sites (SSM/SAM)	***3***	***1.5***	.6	.3	.045
Surface Ships	***7.5-15***	***4.5***	.6	.3	.045
Nuclear Weapons Component	***2.5***	***1.5***	.3	.03	.015
Vehicles	***1.5***	.6	.3	.06	.045
Minefields	***3-9***	***6***	***1***	.03	--
Ports and Harbors	***30***	***15***	***6***	***3***	.3
Coasts, Landing Beaches	***15-30***	***4.5***	***3***	***1.5***	.15
Railroad Yards & Shops	***15-30***	***15***	***6***	***1.5***	.4
Roads	***6-9***	***6***	***1.8***	.6	.4
Urban Areas	***60***	***30***	***3***	***3***	.75
Terrain	*** --***	***90***	***4.5***	***1.5***	.75
Surface Submarines	***7.5-30***	***4.5-6***	***1.5***	***1***	.03

Data Projected to be Available from Commercial Vendors in 1998 Shown in Shaded Cells

Source: MITRE Briefing (Pitt G. Thome, November 1997); Senate Committee on Commerce, Science, and Transportation, NASA Authorization for FY 1978, pp. 1642-1643; and *Reconnaissance Hand Book* (McDonnell-Douglas Corp, 1982), p. 125;Table from Ann M. Florini, "The Opening Skies: Third Party Imaging Satellites and U.S. Security," *International Security*, Vol. 13. No 2 (Fall 1988), pp. 91-123.

[a]Location of a class of units, objects, or activity of military interest.

[b]Determination of general target type.

[c]Discrimination within target type.

[d]Size/dimension, configuration/layout, components construction, equipment count, etc.

[e]Detailed analysis of specific equipment.

conflict with the majority of deployments in 1997 supporting joint operations other than war. This type of mission places a high premium on interoperability to ensure a smooth exchange of both imagery and communication information between military forces. An acquisition approach using commercial sector systems has an inherently high degree of interoperability because the systems are designed according to global commercial standards instead of unique DOD military specifications.

Military Unique Requirements. Commercial systems' inability to meet military unique requirements is often cited as a reason why commercial systems are not practical for the military. However, many of the systems inherently meet a level of these requirements and some acquisition approaches allow the option of inserting MURs into commercial designs.[11]

Following the methodology discussed earlier, Table 3 summarizes the evaluation criteria for each factor—adaptability, reliability, cost and performance. The next step is to define and compare the competing acquisition approaches.

Acquisition Approaches

An acquisition approach is designed to meet warfighters' needs. This section describes six approaches that have the potential to meet warfighters' needs using the

commercial sector: 1) Founder Equity, 2) Strategic Partnership, 3) Anchor Tenant, 4) Commercial-off-the-Shelf (COTS) purchase, 5) Lease/Bulk Purchase, and 6) Direct Purchase of Services. The approaches vary in many aspects but one of the most significant differences is the phase of a project in which the approach is initiated. Figure 3 shows the project cycle phases and the likely place for initiating each acquisition approach.

Table 3. Summary of Criteria for Evaluating Competing Acquisition Approaches

Performance Level vs. Evaluation Factors		Poor Performance (RED)	Acceptable Performance (YELLOW)	Fair Performance (GREEN)	Good Performance (BLUE)
Adaptability		System requires extensive modifications to incorporate technical innovations	System allows modifications to incorporate technical innovations but lags cutting edge	System easily incorporates technical innovations when needed	System automatically incorporates technical innovations to maintain cutting edge
Reliability	**Level of DOD Control**	DOD competes with other customers on equal basis for services	DOD has insight into daily operations and can request changes in priority	DOD can influence daily operations and priorities of service provided	DOD is a system partner, with partial control of decisions setting system priorities
	Ability to Deliver Services On Time	System unable to prioritize delivery of services for preferred customer	System has some ability to provide enhanced service to preferred customer	Vendor can rapidly reprioritize services to provide access and timely delivery	Vendor guarantees access and delivery of services to DOD incl. surge reqmnts
Cost	**R&D and Procurement**	Requires major DOD investment in R&D and procurement of system or military unique components	Minor DOD R&D investment required to complete system design. Major DOD procurement funds required to build or modify system	Vendor pays majority of R&D and procurement costs. DOD required to pay for non-market driven changes i.e. MURs, only	Vendor pays for R&D to maintain cutting edge technology and procures system working w/ DOD to include MURs at lowest cost
	Operations & Maintenance	Vendor owns major components and major responsibilities passing on significant O&M costs to DOD	Vendor owns most components and responsibilities but provides price breaks for long-term DOD purchase/cost commitment	Vendor and DOD share ops of most components and responsibilities with moderate DOD cost commitment	DOD/vendor team identifies most cost effective method of operating system. System costs driven down by large commercial market usage
Performance	**Product Quality**	Vendor supplies services that require DOD modifications to make them acceptable for use	Vendor services meet a subset of basic military requirements	Vendor services meet most military requirements	Vendor services meet military requirements including most MURs
	Production Capacity	Vendor meets military peacetime requirements in populated areas	Vendor meets military wartime requirements in populated areas	Meets military wartime requirements globally	Meets military wartime require-ments globally incl. surge capacity
	Interoperability	System modifications to meet US military requirements make it incompatible with other military equipment and commercial version	System must be modified to meet MURs and loses commercial compatibility but maintains some level of interoperability	System incorporates MURs and allows interoperability with commercial variant but MUR capability is lost when used with commercial variant	System incorporates MURs into common equipment fully compatible with commercial variant and maintains commercial capability in for global use
	Military Unique Requirements	System does not allow incorporation of and does not inherently meet any MURs	System inherently meets minor MURS	System inherently meets most MURs	System inherently meets most MURs and can be modified to meet remaining MURs

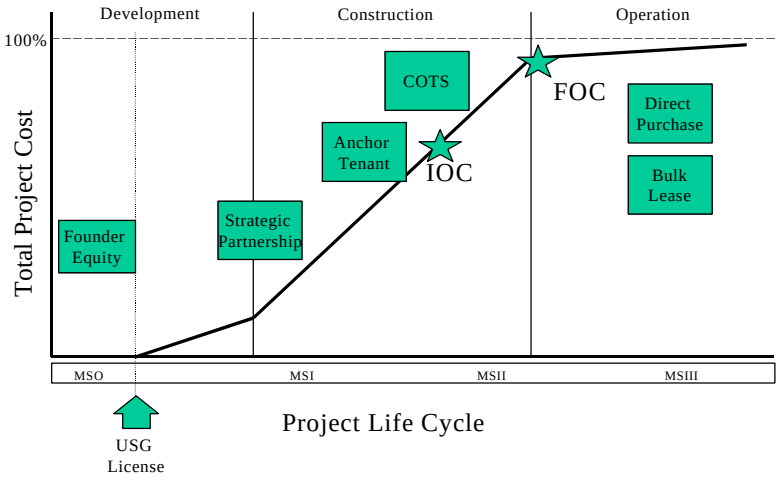

Figure 3. Acquisition Approaches versus Project Cost and Life-cycle

Founder Equity

Founder equity, or seed money, is funding provided in the first stage of a commercial venture to fund initial R&D and start-up costs.[12] Since the project is in the early conceptual stages, the risk of technical and business failure is high. These risks are shared between the commercial venture and its financial investors. In the case of imagery, this approach provides legitimacy to the start-up companies and helps meet the DOC goal of fostering growth in the US commercial imaging sector. This legitimacy enables vendors to secure venture capital needed to bring the systems to fruition. Founder equity also allows the DOD to gain a foothold in a venture that could meet its future needs.

Strategic Partnership

A strategic partnership is a relationship between a particular vendor and the DOD in an arrangement where risk and costs are shared. The specific roles of the government

and the private firms do not follow standard definitions but vary in each arrangement. The relationship may be based on jointly investing in the project, collaborating on a cooperative research effort, or a sharing of functional roles.[13] This approach is based on an operational concept of a combined industry/military team conducting system development, procurement, and O&M functions. It also allows industry to propose concepts leveraging commercial designs to a maximum extent possible while still allowing the DOD to inject some of its MURs.

Anchor Tenant

An anchor tenant agreement is a contract between a vendor and the DOD where the DOD provides funds for a system's construction in return for some specified amount of goods and services upon completion of the system.[14] This option allows the vendor to guarantee a revenue stream once the system is built which helps gain funding throughout the lifetime of the project. The DOD benefits by gaining a commitment for future delivery of services and the opportunity to incorporate MURs in the design of the system.

Purchase of a COTS system

The DOD purchase of satellites and ground equipment identical to a commercial version is an example of the COTS approach. The system would normally be operated and maintained by the vendor in order to take advantage of economies of scale and provide DOD cost savings. The DOD does not incur R&D costs and gains the high reliability benefits of ownership.

Lease / Bulk Purchase

In the lease approach, the commercial vendor privately develops, owns, and operates all of the pieces of a system and provides services to the DOD through a lease or bulk purchase of service. For communications, DISA currently arranges for a level of support from a commercial vendor without specifying which transponders or regions of the world need to be covered. As specific requirements develop, the vendor provides the services up to the limits of the lease/bulk purchase agreement.

Direct Purchase

The last approach is a direct purchase where specific services are purchased at fair-market prices on the spot market. For communications, DISA procures commercial services on a specific case-by-case basis similar to what Defense Communications Contracting Office (DECCO) does through the CSCI program today when it procures specific transponders for specific customers. For imagery, specific imagery requirements would be passed through the NIMA clearinghouse and would be provided by the lowest cost vendor.

Conclusions

Acquisition approaches can be compared by evaluating their ability to meet evaluation criteria. This author's evaluation of the six acquisition approaches against the nine key factors is summarized in Table 4. One general conclusion is product quality is an insignificant factor because all approaches scored roughly equivalent ratings in this area. This is not surprising since the vendor, regardless of approach, must at a minimum provide a sufficient enough level of quality to meet military requirements.

Trade-offs are a major consideration in selecting the right acquisition approach to guarantee delivery of commercial products to the warfighter. A perfect approach scores highly in all factors in theory only. In reality, the evaluation factors overlap and a benefit in one area can be a disadvantage in another, requiring a trade-off between them. The trade-off between reliability and cost discussed earlier is an example. Another trade-off compares interoperability and the ability to incorporate MURs. If a design is modified to incorporate a MUR, it may inherently lose its interoperability with other commercial systems. These trade-offs must be considered when evaluating different approaches.

Table 4. Comparison of Approaches for Acquisition of Commercial Services

	Adapt ability	Reliability		Cost[1]		Performance			
		DOD Control	On Time Delivery	R&D & Proc	O&M	Quality	Capacity	Interoper-ability	MUR
Founder Equity	B	G	G	G	Y	G	G	B	G
Strategic Partnership	Y	B	B	Y	G	B	B	Y	B
Anchor Tenant	G	G	G	Y	G	G	G	G	G
COTS Purchase	Y	B	B	R	G	G	B	G	Y
Lease/Bulk Purchase	B	Y	G	B	Y	G	G	B	R
Direct Purchase	B	R	Y	B	R	G	Y	B	R

Rating Scale: Red-Poor; Yellow- Acceptable; Green-Fair; Blue-Good
[1]A higher cost rating depicts a favorable aspect, i.e. lower DOD cost

Founders Equity Evaluation. The founders equity or "seed money" approach offers several benefits to the DOD. First, it allows the DOD to remain in a flexible position to take advantage of commercial technical innovations because the DOD does not impose design requirements on the system—it allows the commercial partner to drive the system toward market standards. This approach also offers a fair degree of reliability

because a long-term relationship between the DOD and the vendor is established early in the project's cycle. A third benefit is low DOD R&D and procurement costs because the system is in the early stages of development when this approach is initiated. Finally, because the commercial partner is driving the system to compete in a global marketplace it will inherently be interoperable.

Strategic Partnership Evaluation. The primary benefits of a DOD/vendor strategic partnership is a high degree of reliability while leveraging commercial technologies at a lower cost to DOD. This approach also allows the DOD to explore options to incorporate some MURs. One significant drawback of this approach is it forces the DOD to "pick" a partner in the near-term. The concern is the DOD may select a vendor whose system ends up being based on obsolete technology. Finally, interoperability may be reduced if the system has significant MURs designed into it.

Anchor Tenant Evaluation. The primary benefit of the DOD entering into an anchor tenant arrangement is a moderate degree of reliability without losing the adaptability to capitalize on technology innovations. Because the DOD does not get involved in the design of the system the vendor can continually incorporate commercial technology innovations. This translates to a degree of interoperability but because the commitment is made years before the system is operational, there is a risk of selecting a vendor that never gains a significant share of the global market and subsequently goes out of business.

Purchase of a COTS System Evaluation. The primary benefit of purchasing a COTS system is the reliability gained by owning the system. The DOD owns the assets and thus controls the system. However, the DOD would not receive benefits of

adaptability to incorporate commercial technology innovations without paying for significant modifications to the system. This approach also requires the DOD to pay the O&M costs whether the system is fully utilized or not, in addition to the initial procurement costs.

Lease or Bulk Purchase Evaluation. The primary benefits of a bulk purchase or a lease are the system's adaptability and interoperability. Since leases are renewed periodically the DOD would be able to purchase leading-edge products employing the latest technical innovations. This approach also allows the DOD to purchase surge capacity levels and then "sell-back" the unused capacity during peacetime. This provides the vendor a guaranteed revenue stream and eliminates the DOD R&D and procurement costs. The biggest drawback is the DOD cost—long-term leases are more expensive than a purchased system.[15] Other major disadvantages are low reliability because the DOD does not control any portion of the system and the lack of ability to incorporate MURs.

Direct Purchase of Services Evaluation. The primary benefits of a direct purchase of services are the adaptability provided to the DOD by always being able to procure the most technically advanced services, no R&D or procurement costs, and a high degree of interoperability. This approach also provides an inherent surge capacity but is limited by market capacity. The major drawbacks are high costs and lack of reliability. The DOD does not own or control any portion of the vendor's capacity and is in a low leverage position. A third drawback is the lack of ability to incorporate MURs.

Recommendations

An acquisition approach must emphasize *reliability* to guarantee delivery of critical products in time of crisis. In addition, *adaptability*, and *interoperability* must be

emphasized in order to gain the benefits of the commercial sector for the warfighter of tomorrow. These factors can be emphasized numerically by employing a simple weighting technique against the earlier results. Table 5 shows the results when reliability and adaptability are assigned a weighting factor of five, interoperability a four, and the other categories normalized with a three.[16] The conclusions discussed above and the results shown in Table 5 highlight two approaches: strategic partnership and founder equity to guarantee commercial companies deliver space products in time of crisis.

Table 5. Weighted Comparison of Approaches for Acquisition of Commercial Services

	Wghtd Score	Adapt-ability	Reliability		Cost[1]		Performance			
			DOD Control	On Time Delivery	R&D & Proc	O&M	Quality	Capa-city	Interop-erability	MUR
Weighting Factor	--	5	5	5	3	3	3	3	4	3
Founder Equity	**108**	B	G	G	G	Y	G	G	B	G
Strategic Partnership	**109**	Y	B	B	Y	G	B	B	Y	B
Anchor Tenant	99	G	G	G	Y	G	G	G	G	G
COTS Purchase	101	Y	B	B	R	G	G	B	G	Y
Lease/Bulk Purchase	100	B	Y	G	B	Y	G	G	B	R
Direct Purchase	84	B	R	Y	B	R	G	Y	B	R

Rating Scale: Red-Poor (1); Yellow- Acceptable (2); Green-Fair (3); Blue-Good (4)
Weighting Factors: Low (1); Average (2); Medium (Normalized Value) (3); High (4); Very High (5)
[1]A higher cost rating depicts a favorable aspect, i.e. lower DOD cost

This analysis uses a scenario to illustrate how the strategic partnership and founder equity approaches could be used together to guarantee warfighters get the critical space products when they need them. The strategic partnership approach is used to meet the near-term requirements and founder equity approach will meet the long-term military

requirements. In this scenario, warfighters will rely on commercial sources to meet military requirements for 1-meter resolution imagery transmitted to tactical ground forces deployed around the globe through a network of low earth orbit (LEO) communications satellites.

Strategic Partnership: A Near-Term Approach

A strategic partnership between the DOD and a commercial vendor can meet scenario requirements in the three to five year timeframe. Under this approach the vendor would be responsible for collecting the imagery or subcontracting this function. Imagery would be transmitted via joint DOD/vendor owned communications satellites which augment the vendor's commercial constellation. The communication network's design would be based on the vendor's commercial communication system and the DOD will be responsible for the design modifications for encryption and security features. The DOD will also be responsible for launching both the commercial and DOD/vendor systems to orbit. Finally, the vendor will be responsible for the system's O&M leveraging its technical innovations and experience allowing the DOD to actively participate in service prioritization.

This strategic partnership approach ensures the DOD gains the reliability to control the system and ensures the timeliness of delivery. Interoperability is achieved because the partnership leverages the commercial system and allows the design to be built to commercial standards vice military specifications. This option also allows the DOD to infuse its MURs into the design and trade them off against LCC and interoperability.

This near-term approach can meet the DOD requirements for collection and transmission of 1-meter imagery for the three to five year period after system reaches

Initial Operational Capability (IOC). This allows the DOD to take advantage of the current state of the commercial market and leverage the shorter commercial acquisition cycle times. A second strategic partnership would be initiated in the commercial sector three to five years in the future to take advantage of the commercial market at that point. This series of partnerships allows the DOD to maintain use of leading edge technologies and a high degree of interoperability while still guaranteeing a reliable delivery of commercial products.

Founder Equity: A Long-Term Approach

To meet the long-term requirements outlined in the scenario above, the government could enter into several founder equity arrangements looking to leverage the emerging imagery and communication technologies. Government "funding" could be in the form of an innovative approach where the government provides "insurance" against launch and on-orbit failures. This form of insurance would help the start-up commercial ventures since this launch and on-orbit failure insurance represents up to 22% of total system costs. Typically, government programs do not purchase insurance and instead self-insure, so the precedent has already been set[17]. The vendor would be responsible for R&D and procurement costs for the system. Since the system is designed to compete in the commercial marketplace, it inherently provides the DOD interoperability around the globe. Finally, it also provides the DOD the greatest adaptability to incorporate leading edge technologies

The founder equity "partners" become candidates for follow-on strategic partnerships. The systems being developed by the commercial partners are several years from IOC and could benefit greatly from USG backing during this start-up phase. Thus,

the founder equity approach requires the government to invest in more than one venture to ensure participation with the commercial marketplace "winner" three to five years in the future. Finding the required funding to do this within an austere budget environment is a problem. A potential solution is DOC sponsored programming for funding outside of the DOD budget. This would help maintain the US lead in the space sector while providing the DOD the required technical adaptability. Another solution highlighted above is the offer of government insurance in lieu of direct government funding.

In summary, the combination of strategic partnership and founder equity approaches work together to provide a near and long-term guarantee of delivery of critical commercial space products when the warfighters need them the most.

Notes

[1] Department of Defense, Defense Systems Management College, *Program Manager's Handbook*, June 1993, 1.2-2.

[2] CMDR Dave Brown, Defense Systems Management College, interviewed by author via Internet, 18 Mar 98. CMDR Brown pointed out the USN fell into a trap during DESERT STORM by relying on the commercial merchant marine fleet to meet sea lift surge requirements. However, the USN never "mobilized" the commercial ships for day-to-day ops during peacetime and faced stiff resistance when it was done during wartime. CMDR Brown's comments, "The US Merchant Marine is heavily subsidized and heavily protected. There is a law that says that any cargo transferred between US ports must be carried on US flagged ships. The argument has always been that we must protect the US Merchant Marine so that we have ships to augment the Military Sea Lift Command in time of war to carry the heavy equipment and supplies overseas. Unfortunately, the result has been an ever diminishing merchant marine that is not competitive in the world shipping market and tends to operate in its protected little niche between U.S. ports. When DESERT SHIELD started, these companies immediately complained that if we took their ships, that 1) the economy of the U.S. would be disrupted and 2) if other ships were allowed to pick up the slack that they would be driven out of business after the war. As a result, the U.S. leased a lot of shipping for the Gulf War, but they leased it from whatever source they could find."

[3] Jonathan Ball, "Satellite Remote Sensing," *TCS Remote Sensing and GIS*, n.d., n.p.; on-line, Internet, 22 Oct 97. Available from http://cher.eda.doc.gov/pasc/rmtsens.hmtl.

[4] Jonathan Ball, "Satellite Remote Sensing," *TCS Remote Sensing and GIS*, n.d., n.p.; on-line, Internet, 22 Oct 97. Available from http://cher.eda.doc.gov/pasc/rmtsens.hmtl. According to Ball, routine SPOT timeliness is 2-3 weeks for electro-optic panchromatic

imagery and the Canadian Radarsat provided a synthetic aperture radar image in 5-10 days. PDD-23 stipulates a US commercial imagery licenses requires the vendor to provide a data down link format allowing USG access during times of crisis or conflict. Gil Rye, Orbimage Corporation, interviewed by author, Sterling, Virg., 10 Dec 1997. According to Rye, some of the US companies are building in direct down link (DDL) capability into their systems allowing a warfighter to receive direct broadcast from a satellite. This scheme however would still require either a government provided or contractor provided imagery analyst in theater to exploit the imagery.

[5] Program Executive Officer/SCS, briefing, subject: *"M-Star like" Moving with the Marketplace*," 5 Jun 97.

[6] Department of Defense, Defense Systems Management College, *Program Manager's Handbook*, June 1993, 2.2-2.

[7] National Imagery and Mapping Agency, *Commercial Satellite Imagery Concept of Operations*, (Washington, D.C., May 1997), 27. NIMA, as the clearinghouse for the USG, would enter into a contract with vendors that specifies a certain user group (e.g.. a Level 4 license allows distribution of the image to the intelligence community (IC) users, DOD users, Federal civil users, and Coalition Force users.) A Level 4 license would be expensive when compared to a single user license (i.e. Level 1).

[8] National Imagery and Mapping Agency, *Commercial Satellite Imagery Concept of Operations*, 16.

[9] J.R. Batzler, CNA, briefing, subject: Commercial Imagery Options: Leveraging Commercial Imagery for use by DOD and the Civil Federal Government in Support of National Security, 22 Nov 1996, 35.

[10] Contractor whitepaper, USSPACECOM, "Alternatives for Integrating Commercial High Resolution Imaging Satellites in the Future Architecture," Nov 97.

[11] Briefing, Defense Information Systems Agency, subject: DOD Use of Mobile Satellite Systems, n.d., 36. According to the briefing, many commercial communications systems have an inherent LPI/LPD capability built in. J.R Batzler, CNA, briefing, subject: Commercial Imagery Options: Leveraging Commercial Imagery for use by DOD and the Civil Federal Government in Support of National Security, 22 Nov 1996, 35. According to Batzler, a US commercial imagery licenses requires a direct down link (DDL) capability built into the system.

[12] Don Trayer, USN/SPAWAR, *Commercial Space Acquisition: A Glossary*, n.d., 3.

[13] Ibid, 5.

[14] Ibid, 1.

[15] Warren Ferster, "Pentagon Officials Consider Commercial Satellite to Fill Communications Needs," *Army Times* 58, no. 8 (22 Sep 1997): 2.

[16] The weights assigned for this analysis were chosen by the author based on the research presented earlier in the paper. Chapter two pointed to the importance of *adaptability* and it is emphasized with a weighting factor of five. Chapter four highlighted both aspects of *reliability, DOD control* and *On-time delivery*, and they are given weighting factors of five. The increase in joint and combined operations, discussed in chapter three, requires an emphasis on *interoperability* which is given a weighting factor of four.

Notes

[17] The Office of Federal Procurement Policy (OFPP) established the government policy of "self-insurance." This is based on the concept that it is cheaper for the government to accept the risk of failure or loss than to purchase insurance. In the event of a launch or on-orbit failure, the government agency responsible for the asset will develop and obtain approval of a recovery plan. Recovery options include obtaining additional appropriations from Congress, reprogramming funding within the program, or deleting the requirement.

Chapter 6

Conclusions and Summary

> *No one starts a war—or rather, no one in his sense ought to do so—without first being clear in his mind what he intends to achieve by war and how he intends to conduct it.*
>
> —Carl von Clausewitz

Information Superiority is the vision for tomorrow's battlefield and requires the military to increase the amount of information and speed with which it is transferred to win in battle. This concept is forcing the military to use space as the medium for collection and distribution of information and the magnitude of the requirements is forcing the military to use commercial sources to augment DOD systems. In addition, the commercial sector is now the leader in developing new technologies and the DOD must leverage these or face fighting the next war with obsolete weapons. Tomorrow's warfighters should heed von Clausewitz's observation and strive to understand how war will be fought by relying on commercial partners in the conduct of war—a radical change from the past.

The transfer of military requirements from DOD owned and operated systems to commercial solutions is a complex and difficult transition. However, it cannot be avoided if the military vision of Information Superiority is to be realized. Additionally, budget pressures are forcing DOD program managers and warfighters to look at commercial solutions to exploit commercial technology breakthroughs without large

DOD R&D investments. The bottom line is the DOD must continue on the path of meeting requirements with commercial sources.

This path has complex and unknown challenges. It is forcing military acquisition officials to consider new ways of doing business. Fundamentally, it is forcing the military to *rely* on the commercial sector to provide the services it *requires* to win on the battlefield today and in the future. The new competitors for resources in the battle for Information Superiority may not be enemy military forces but rather enterprising businesses and media interests. In such a complex environment there are no "single solutions." Near-term solutions must be selected and then revisited often to ensure the DOD maintains its adaptability. The SWarF decision to buy three communication satellites to fill a near-term gap in capability is an example of what will become the new way of doing business—selecting a near-term solution to preserve flexibility in the future.

Strategic partnership is the best approach to gain reliable delivery of critical products because the DOD owns a stake in the venture. Founders Equity works hand-in-hand with strategic partnership by growing military-commercial relationships so the "strategic partner after next" is available when needed. These approaches meet the goals of adaptability, interoperability, and reliable delivery in time of crisis—in essence, the commercial sector can provide the warfighter what is needed to win in battle.

Glossary

ACSC	Air Command and Staff College
ACTD	Advanced Concept Technology Demonstration
AFB	Air Force Base
AFSAB	Air Force Scientific Advisory Board
AU	Air University
CINC	Commander-in-Chief
CNN	Cable News Network
CONOP	Concept of Operations
CONUS	Continental United States
COTS	Commercial-Off-the-Shelf
CSCI	Commercial Satellite Communications Initiative
CSIL	Commercial Satellite Imagery Library
DDL	Direct Down Link
DECCO	Defense Communications Contracting Office
DIA	Defense Intelligence Agency
DISA	Defense Information Services Agency
DOC	Department of Commerce
DOD	Department of Defense
DODD	Department of Defense Directive
DSCS	Defense Satellite Communication System
EO	Electro-optical
FCC	Federal Communications Commission
FOC	Full Operational Capability
FSS	Fixed Satellite Service
FY	Fiscal Year
GAO	General Accounting Office
GP	General Purpose (communication traffic)
GPS	Global Positioning System
ID	Identification
INMARSAT	International Maritime Satellite
INTELSAT	International Satellite (a communications satellite system owned by an international consortium)

IOC	Initial Operational Capability
J6	Joint Staff/Communications Directorate
JV2010	*Joint Vision 2010*
LCC	Life Cycle Cost
LEO	Low earth orbit
LPD	Low Probability of Detection
LPI	Low Probability of Intercept
MCC	Mission Control Complex
MILSATCOM	Military Satellite Communications
MSI	Multi-Spectral Imagery
MSS	Mobile Satellite Service
MUR	Military Unique Requirement
NIMA	National Imagery and Mapping Agency
NOAA	National Oceanic Atmospheric Agency
NTM	National Technical Means
NWC	Network Centric Warfare
O&M	Operations and Maintenance
PDD	Presidential Decision Directive
R&D	Research & Development
SAR	Synthetic Aperture Radar
SASC	Senate Armed Services Committee
SATCOM	Satellite Communications
SPOT	Satellite pour l'Observation de la Terre (French imaging satellite)
SWarF	Senior Warfighters Forum
US	United States
USAF	United States Air Force
USG	United States Government
USMC	United States Marine Corp
USN	United States Navy
VTC	Video Teleconference
WRC	World Radio Communications

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